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Indian Standard

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(Reaffirmed 2020)

कृषिवस्त्रादि — कृषि और बागवानी प्रयोजनों के लिए कीट जाल — विशिष्टि

Agro Textiles — Insect Nets for Agriculture and Horticulture Purposes — Specification

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Technical Textiles for Agro-tech Sectional Committee, TXD 35

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Technical Textiles for Agro-tech Sectional Committee had been approved by the Textile Division Council.

Insect nets are used in various agriculture and horticulture applications mainly to protect vegetables and fruits from those crop insects that are small in stature but cause severe damage to vegetables and fruit on a large scale. These nets provide protection from insect such as aphids, whitefly, carrot fly, cabbage root fly and caterpillars etc, and also allow adequate vital sunlight, air and water for plants to grow.

The guidelines for installation of insect nets is given in Annex D for information only.

The composition of the Committee responsible for the formulation of this standard is given in Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AGRO TEXTILES — INSECT NETS FOR AGRICULTURE AND HORTICULTURE PURPOSES — SPECIFICATION

1 SCOPE

This standard prescribes constructional and other requirements for insect nets for agriculture and horticulture purposes in protecting crop from insects such as aphids, whitefly, carrot fly, cabbage root fly and caterpillars etc.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 16366 and the following shall apply.

3.1 Cover Factor — It is the area of insect nets covered by the yarn of the structure.

3.2 Mesh — The number of openings per inch in longitudnal direction.

4 MATERIALS

4.1 HDPE Monofilament Yarn

Monofilament yarn shall be manufactured from HDPE granules, which shall be UV stabilized by adding suitable UV stabilizer. Linear density of the monofilament yarn shall be 42.2 Tex (380 denier). As agreed to between the buyer and the seller, coloured monofilament yarn shall be manufactured using colour master batch. The denier of HDPE monofilament yarn used in the manufacture of insect nets shall be subjected to the following tolerances:

a) 10 percent on individual value; and
b) 5 percent on average.

4.1.1 The heat shrinkage of the monofilament yarn at 60°C shall not exceed 5 percent when subjected to the specified temperature for a period of 10 min in an air circulating oven. The heat shrinkage of the monofilament yarn at 95°C shall not exceed 10 percent when subjected to the specified temperature for a period of 10 min in hot water bath.

4.2 Netting Fabric

The fabric used in the manufacture of insect nets shall be woven on shuttle less weaving machine and shall have a minimum width of 2 m. The fabric shall have tucked in type selvages and width of selvages shall be minimum 10 mm. A tape of 1.70 ± 0.1 mm width having the name of manufacturer shall be provided at the end which shall run through the complete length of the roll for identification of manufacture.

4.3 Colour

The colour of the fabric shall preferably be natural white or milky white. However any other colour or a mixture of colour may be supplied as per the agreement between the buyer and the seller. The colour/shade shall be as specified in the contract or order. In case a sample has been agreed upon and sealed, the supply shall be made in conformity with the sample in such respects.

5 TYPES

Based on the mesh, the insect nets are classified as follows:

a) *Type I* — having mesh of 30;
b) *Type II* — having mesh of 40; and
c) *Type III* — having mesh of 50.

6 REQUIREMENTS

6.1 Dimensions and Mass

The insect nets shall be made to the colour and dimensions as specified in the contract or order. The dimensions shall be determined by the method prescribed in IS 1954. The following tolerance shall be permissible for length, width and mass (g/m^2);

Dimension	*Tolerance*, percent
Length	$^{+1}_{-0}$
Width	$^{+1}_{-0}$
Mass, g/m^2	± 5

6.2 The insect net fabric shall confirm to the requirements specified in Table 1.

Table 1 Requirements of Insect Nets

(*Clause* 6.2)

Sl No.	Characteristic(s)	Requirements			Tolerance	Method of Test, Ref to
		Type I 30 mesh	Type II 40 mesh	Type III 50 mesh		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Mass, g/m^2	90	105	125	± 5 percent	IS 1964
ii)	a) Ends per inch b) Picks per inch	30 24	40 24	50 24	± 2 ± 2	IS 1963
iii)	Cover factor, percent, *Min*	30	40	50	—	Annex B
iv)	Breaking strength of insect nets fabric before UV exposure (ravelled strip method 325 mm × 70 mm)1), kg, *Min*				—	IS 1969 (Part 1)
	a) Warpway	80	120	140		
	b) Weftway	50	65	70		
v)	Retention in breaking strength after UV exposure, kg, *Min*	← 85 percent of original actual value of fabric →			—	Annex C and IS 1969 (Part 1)
vi)	Bursting strength, kg/cm^2, *Min*	10	18	20	—	IS 1966 (Part 1) or IS 1966 (Part 2)
vii)	Air permeability in mm/s at 50 pascal water head pressure, *Min*	6 500	5 000	3 000	—	IS 11056

1) Width after raveling = 50 mm, Gauge length = 200 mm.

7 PACKING AND MARKING

7.1 Packing

The insect nets shall be packed in roll form in length of 100 m or in bundle form or as agreed to between the buyer and the seller.

7.2 Marking

7.2.1 Each fabric roll/bundle shall be marked legibly by affixing a label with the following information:

a) Indication of the source of manufacture;
b) Type and mesh size;
c) Declared length and width of the insect nets;
d) Mass per square meter of the insect nets;
e) Batch No. and date of manufacture; and
f) Any other information desired by the buyer.

7.3 BIS Certification Marking

The insect nets may also be marked with the Standard Mark.

7.3.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of the conditions under which a license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

8 SAMPLING

8.1 Lot

All insect nets rolls/bundles of same construction and type dispatched to a buyer against one dispatch note shall constitute a lot.

8.2 Unless otherwise agreed to between the buyer and the seller, the number of insect nets rolls/bundles to be selected at random from a lot shall be as given in col 3 of Table 2.

Table 2 Scale of Sampling

(*Clause* 8.2)

Sl No.	No. of Rolls in Lot	Sample Size	Sub-sample Size	Permissible No. of Defective Rolls
(1)	(2)	(3)	(4)	(5)
i)	Up to 50	3	2	0
ii)	51 to 150	5	2	0
iii)	151 to 300	8	3	1
iv)	301 to 500	13	5	2
v)	501 and above	20	5	3

9 NUMBER OF TEST SPECIMENS AND CRITERIA FOR CONFORMITY

Number of test specimens and criteria for conformity shall be as given in Table 3.

Table 3 Number of Test Specimens and Criteria for Conformity

(*Clause* 9)

Sl No.	Characteristic	No. of Rolls/ Test Specimens	Criteria for Conformity
(1)	(2)	(3)	(4)
i)	Length, width, ends per inch, picks per inch, mass, breaking strength before UV exposure and material	According to col 3 of Table 2	The defective rolls do not exceed the corresponding number given in col 5 of Table 2
ii)	All other requirements	According to col 4 of Table 2	All the test specimens shall pass the tests

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
1954 : 1990	Determination of length and width of woven fabrics — Methods (*second revision*)
1963 : 1981	Methods for determination of threads per unit length in woven fabrics (*second revision*)
1964 : 2001	Methods for determination of mass per unit length and mass per unit area of fabrics (*second revision*)
1966	Textiles — Bursting properties of fabrics — Determination of bursting strength and bursting distension:
(Part 1) : 2009	Hydraulic method (*second revision*)
(Part 2) : 2009	Pneumatic method (*second revision*)
1969 (Part 1) : 2009	Textiles — Tensile properties of fabric — Determination of maximum force and elongation at maximum force: Part 1 Strip method (*third revision*)
11056 : 2013	Textiles — Determination of the permeability of fabrics to air
16366 : 2015	Glossary of terms used in agrotextile

ANNEX B

[*Table* 1, *Sl No.* (iii)]

DETERMINATION OF COVER FACTOR

B-1 This method prescribes determination of cover factor of insect nets.

B-2 APPRATUS

B-2.1 Thread Counter — A thread counter, equipped with a low power microscope of suitable magnification and a pointer which traverses along a graduated base. In the absence of such a thread counter, an ordinary counting glass with an aperture of 50 mm may be used.

B-2.2 Dial Thickness Gauge or Micrometer

B-2.3 Table, having smooth flat surface of sufficient length and width to accommodate test specimen.

B-3 TEST SPECIMEN

B-3.1 Take 5 test specimens from each of the warp and the weft directions from the test pieces.

B-3.2 Specimens shall not contain dirt, irregular spots, creases, holes or other visible faults.

B-3.3 Any two specimens shall not contain the same warp or weft threads. Test specimen shall be taken at least 50 mm from the selvages.

B-4 CONDITIONING

B-4.1 Conditioning

Condition the test specimen at 27 ± 2°C and 65 ± 5 percent relative humidity for not less than 24 h prior to test.

B-4.2 Test Conditions

Conduct test in the standard laboratory atmosphere of 27 ± 2°C and 65 ± 5 percent relative humidity.

B-5 TEST PROCEDURE

B-5.1 Determination of Number of Warp and Weft Threads Per Inch or Mesh

Lay on a flat table a portion of one of the pieces constituting the test sample and smoothen it out. Place the counting glass with the pointer at zero on the piece in such a way that (a) on turning the screw the pointer moves in a direction parallel or perpendicular to warp threads, depending upon which set of threads (warp or weft) is being counted, and (b) the pointer shall coincide either with the right hand or the left-hand edge of a thread, depending on whether the counting is started from right to left or from left to right direction. Find the number of warp or weft threads by counting the number of units comprising one thread and one space. Calculate the number of threads per inch in warp and weft direction. Take the average of five reading both in warp and weft direction.

B-5.2 Measure the diameter of mono filament yarn by dial thickness gauge or micrometer in mm in yarn flattened state and convert it to inch. Take at least 10 number of readings each in warp and weft direction and calculate the average diameter in warp and weft direction.

B-6 CALCULATIONS

B-6.1 Determine the open area by following formula:

$$\begin{array}{c}\text{Open Area,}\\(OA)\text{ percent}\end{array} = \begin{array}{c}[100\left(1 - EPI \times d_1\right)\\ \times (1 - PPI \times d_2)]\end{array} \times OL$$

where

EPI = ends per inch;

PPI = picks per inch;

d_1 = average diameter of the warp threads, in inches;

d_2 = average diameter of the weft threads, in inches; and

OL = multiplication factor for overlapping of warp and weft threads, taken as 1.03.

B-6.2 Determine the cover factor by following formula:

Cover Factor = 100 – Open Area, (OA)

ANNEX C

[*Table* 1, *Sl No.* (v)]

ULTRA VIOLET RESISTANCE TEST

C-1 TEST SPECIMENS

The test specimens for breaking strength shall be cut from the sample as specified in IS 1969 (Part 1).

C-2 TEST CONDITIONS

C-2.1 The test shall be carried out with fluorescent UV-B lamp (313 nanometer or its equivalent).

C-2.2 The duration of the test shall be 144 h (that is 6 days).

C-2.3 The test cycle shall be 8 h at 60 ± 3°C with UV radiation alternating after 4 h at 50 ± 3°C with condensation.

C-2.4 Irradiation level throughout the test shall be maintained at $0.63\ ^{+0.03}_{-0.0}$ W/m^2.

C-3 TEST PROCEDURE

C-3.1 Determine the original average breaking strength of insect nets specimens separately as per the test specified in IS 1969 (Part 1).

C-3.2 Expose the specimens alternately to ultraviolet light alone and to condensation in one respective cycle.

C-3.2.1 The type of fluorescent UV lamp, the timing of the UV exposure and the temperature of condensation shall be as specified in **C-2**.

C-3.3 Determine the average breaking strength of the specimens separately after UV exposure as mentioned above.

C-3.4 Determine the percent retention of original strength as follows:

$$\text{Percent retention of original breaking strength} = \frac{b}{a} \times 100$$

where

a = average breaking strength before UV exposure as obtained in **C-3.1**; and

b = average breaking strength after UV exposure as obtained in **C-3.3**.

NOTES

1 The UV source is an array of fluorescent lamps (with lamp emission concentrated in the UV range).

2 Condensation is produced by exposing the test surface to a heated, saturated mixture of air and water vapour, while the reverse side of the test specimen is exposed to the cooling influence of ambient room air.

ANNEX D

(*Foreword*)

GUIDELINES FOR INSTALLATION OF INSECT NETS

D-1 PREAMBLE

D-1.1 The primary function of insect nets applied in agriculture applications is protection of crop from insects. It can be used in polyhouse and shadenets house. The durability of insect nets is based on a good quality material and proper installation technique.

D-1.2 To improve the service life of insect nets, it is essential that the insect nets are placed on suitable structures according to the dimensions. To achieve this proper onsite laying, joining and fixing of insect nets is imperative.

D-2 LOGISTICS

Insect nets are packed in roll form/bundle form with suitable packing material and transported by appropriate means to protect the insect nets and avoid any type of damage. Rolls of insect nets are loaded manually/with forklift and can be unloaded in a similar manner at the destination. Use of hooks shall be avoided for loading and unloading of the rolls of insect nets at site.

D-3 STORAGE AT SITE

D-3.1 The insect nets shall be stored so as to protect them from damage, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or any other damage. The rolls/bundles shall be stored on a prepared surface and to be stacked not more than three rolls/ bundles.

D-3.2 The owner of the site where the insect nets is to be installed shall provide storage space in a location sufficiently near the insect nets structure to minimize any additional handling.

D-3.3 The storage area shall be protected from theft, vandalism, vehicular traffic and any other source which could create potential damage to the insect nets.

D-4 PLANNING FOR INSECTNETS HOUSE

D-4.1 The insectnets house structure shall be planned taking into consideration the type of crop to be grown, locally available materials and the finance budget and local climatic conditions. The provision should be there for future expansion.

D-4.2 Several designs are available with local branches of National Horticultural Mission. One can choose the design based on criteria listed above.

D-5 SITE CONSIDERATIONS

Insectnets house should be located in such a way that it is well connected with market for input supplies and sale of its produces. Structure shall be constructed away from buildings, trees, industrial and vehicular pollutants; means location shall be fairly shadow free. Construction site shall be at higher elevation than surrounding land with adequate drainage facility. There should be provision of electricity and good quality water. However, wind breakers may be located 30 m away from the structure.

D-6 STRUCTURAL MATERIALS

D-6.1 Insectnets house structure composed of two basic components that is frame and cladding material. The insectnets house frame provides support for cladding material and designed to protect against wind, rain and crop load.

D-6.2 Depending on the costs involved in the construction, there are following three types of insectnets houses.

a) *Low cost* — The low cost insectnets house is made of a supporting structure of bamboo/ wood/local available materials. It does not have any climate control system.

b) *Medium cost* — The medium cost insectnets house is made of a supporting structure of G.I. pipes, profile springs and wires.

c) *High cost* — The high cost insectnets house is made of supporting structure of steel tubes and has many facilities like auto control mechanism, heating, cooling and humidification system, micro irrigation system etc.

D-6.3 The structure has to carry the following loads and is to be designed accordingly.

a) *Dead load* — Weight of all permanent construction, cladding, heating and cooling equipment, water pipes and all fixed service equipments to the frame.

b) *Live load* — Weights superimposed by use (include hanging baskets, shelves and persons working on roof). The insectnets house shall be designed for a maximum of 15 kg/m^2 live load. Each member of roof shall be capable of supporting 45 kg of concentrated load when applied at its centre.

c) *Wind load* — The structure shall be able to withstand winds of 120 km/h and at least 50 kg/m^2 of wind pressure.
d) *Snow load* — These are to be taken as per the average snowfall of the location. The insectnets house shall be able to take dead load plus live load or dead load plus wind load plus half the live load.

D-7 COMMENCEMENT OF INSECT NETS INSTALLATION WORK

a) Before starting the insect nets installation, the contractor shall issue a certificate of stability of erected insect nets structure, to enable to commence insect nets installation work.
b) Chain linked fencing shall be put around the insectnets house to prevent stray entry of men and animals to protect any damage to the insect nets.

D-8 INSECT NETS LAYING OPERATIONS

a) While laying the insect nets, precaution shall be taken to avoid any damage to it.
b) The insectnets house area shall be declared as a 'NO SMOKING ZONE'.

D-9 INSECT NETS INSTALLATION OPERATION

a) Measure out about 25 percent more insect nets fabric than needed to cover the entire structure. Unroll the insect nets fabric across the structure, leaving at least one foot of nets fabric overhanging on all sides. Pull the nets fabric into position, straightening as needed.
b) Start with the longest side one will be covering and affix the nets fabric with staples every 12 inches across the structure. Staple near the inner side of the board so that they will not interfere while cutting the edges off the fabric. Keep the fabric tight and the lines on the knitting straight while working across the length of the structure.
c) Begin stapling on the closest short side, keeping the insect nets fabric evenly lined up while heading in the direction away from the home. Always continue in the same clockwise or counter clockwise motion one began with. When attaching the nets fabric, never start stapling from an unattached side.
d) After finishing the last edge, try to avoid any overlap in the fabric. Affix the nets fabric to rafters and centre supports of the structure as needed.

D-10 POST INSTALLATION PRECAUTIONS

D-10.1 Insectnets house and systems, since they are in constant operation, requires proper maintenance regularly. The frequency of services/examinations shall be in accordance to the extent of exposition of the insectnets house to hazardous conditions.

D-10.2 During the first two months of cladding of insect nets, it is very important to tighten them, whenever they become loose and to maintain a tight stretch of the nets. After the first two months, the natural spread of the nets is significantly reduced and stretching is required only once a year, or after harsh storms. This measure keeps the nets tight at a high level. This helps to prevent damage to the nets and extends its life span.

D-10.3 If no unusual events take place during the first year following completion of construction, it is necessary to conduct an examination of insectnets structure once a year. This examination shall be conducted prior to the season of strong winds and rain, as follows:

a) Verify the exposure of the columns from ground soil, if any. Conduct a random examination of the foundations; verify that they are intact. If there are cracks or damages, pour new foundations.
b) Verify that there are no tears or holes in the insect nets covering. Repair and fasten, if required.
c) Verify that there is no threat of flooding of the insectnets house as a result of any new groundwork conducted in the surrounding area adjacent to the structure.
d) Clean the insectnets house area from any debris that is likely to blow away and damage the structure of the insect nets covering. Verify that the insect nets is securely sewn in place.

ANNEX E

(*Foreword*)

COMMITTEE COMPOSITION

Technical Textiles for Agro-tech Sectional Committee, TXD 35

Organization	*Representative(s)*
The Synthetic & Art Silk Mills Research Association, Mumbai	Dr U. K. Gangopadhyay (***Chairman***)
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